DRILLING APPARATUS

BACKGROUND OF THE INVENTION

This invention relates to drilling apparatus of the type which embodies an elongated frame which supports a transmission unit for longitudinal movement thereof with the transmission unit operatively connecting a polygonal drive shaft to a driven head which is threadedly connected to a drill rod section for drilling a hole into the earth.

Heretofore in the art to which my invention relates, it has been the usual practice to position the drill rod sections sequentially in axial alignment with the driven head of the apparatus by employing a rotatable drill rod rack which was supported outwardly of the frame carrying the drilling apparatus. Such prior art drill rod racks have been supported by arms which swing the entire drill rod rack from the outer inoperative position to an inner operative position. Accordingly, such drill rod racks not only require rotation of the drill rod rack to position selected ones of the drill rod sections in position to move beneath the driven head but also the entire drill rod rack must be swung from the position outwardly of the drill rod frame to a position to align a drill rod section with the driven head. This requires a considerable amount of time and effort due to the fact that the drilling operation must be stopped as the entire drill rod rack is swung from the outer inoperative position to the inner position in addition to the time required to rotate the drill rod rack to position the next drill rod section in proper position to move into axial alignment with the driven head.

Difficulties have also been encountered in providing quick-acting breaker units for breaking the joint between the drill rod section and another drill rod section or a drill bit. That is, such breaker units are complicated in structure and require manual actuation of the various components of the breaker units. This not only requires a considerable amount of time and effort on the part of the worker but also requires that the worker be present at the location of the joint being broken or made, thus exposing the worker to the elements and also to the danger encountered in handling drill rod sections as the joints are made or broken.

CROSS REFERENCE TO RELATED PATENT APPLICATION

My improved apparatus is particularly adapted for use with the drilling apparatus disclosed and claimed in my co-pending U.S. patent application Ser. No. 958,985, filed Nov. 9, 1978, and entitled "DRILLING APPARATUS".

SUMMARY OF THE INVENTION

In accordance with my present invention, I overcome the above and other difficulties by providing drilling apparatus which embodies a drill rod rack which is mounted for rotation about an axis within the confines of the main, elongated supporting frame for the drilling apparatus. The drill rod rack carries a plurality of angularly spaced drill rod sections which are moved sequentially into axial alignment with the driven head. Accordingly, as the drill rod rack is rotated to position the next drill rod section for insertion into the drilling apparatus, it is not necessary to pivot the entire drill rod rack from an outer position to an inner position to position such next drill rod section in axial alignment with the driven head. Also, it is not necessary to remove the drill rod rack from the drill rod section thus inserted into the drilling position. That is to say, each drill rod section is positioned to drill a hole while extending through the drill rod rack without having to swing the entire drill rod rack from an outer inoperative position to an inner operative position and then back out to the inoperative position before the drilling operation can proceed.

In accordance with my invention, I also provide improved means for breaking the joint between the drill rod sections or between a drill rod section and a bit. My improved breaker unit is mounted in axial alignment with the driven head and includes an annular member which is releasably connected to a transverse frame and to a drill rod section extending therethrough.

DESCRIPTION OF THE DRAWINGS

Drilling apparatus embodying features of my invention is illustrated in the accompanying drawings, forming a part of this application, in which:

FIG. **1** is a side elevational view showing the drilling apparatus in position to drill a hole vertically into the earth, the drill rod rack and the drill rod sections carried thereby being omitted for the sake of clarity;

FIG. **2** is a front elevational view looking from the left side of FIG. **1**;

FIG. **3** is a vertical, sectional view taken generally along the line **3—3** of FIG. **1** and showing the drill rod rack and the drill rod sections carried thereby;

FIG. **4** is an enlarged, vertical sectional view through the upper portion of the apparatus shown in FIG. **3**;

FIG. **5** is an enlarged, vertical sectional view showing the lower portion of the apparatus shown in FIG. **3** and taken generally along the line **5—5** of FIG. **8**;

FIG. **6** is a sectional view taken generally along the line **6—6** of FIG. **5**;

FIG. **7** is a horizontal, sectional view taken generally along the line **7—7** of FIG. **4**;

FIG. **8** is a horizontal, sectional view taken generally along the line **8—8** of FIG. **5**;

FIG. **9** is a horizontal, sectional view taken generally along the line **9—9** of FIG. **5** and drawn to a larger scale;

FIG. **10** is an enlarged, fragmental view taken generally along the line **10—10** of FIG. **9** showing the lower end of the drill rod section in the position that it assumes just prior to passage through the opening in the rack;

FIG. **11** is a fragmental, sectional view corresponding to FIG. **10** showing the drill rod section inserted through the opening in the rack;

FIG. **12** is a fragmental, sectional view taken generally along the line **12—12** of FIG. **10**;

FIG. **13** is an enlarged, fragmental view taken generally along the line **13—13** of FIG. **5**;

FIG. **14** is a view corresponding to FIG. **13** showing the breaker unit in position to break the joint between drill rod sections;

FIG. **15** is a fragmental, sectional view taken generally along the line **15—15** of FIG. **13**;

FIG. **16** is a sectional view taken generally along the line **16—16** of FIG. **9**;

FIG. **17** is an enlarged view, partly broken away and in section, showing the upper portion of the drill rod rack shown in FIG. **4**;

FIG. **18** is a sectional view taken generally along the line **18—18** of FIG. **17**; and,